

**REFLECTIVE AND TRANSMISSIVE MODE MONOLITHIC MILLIMETER  
WAVE ARRAY SYSTEM AND IN-LINE AMPLIFIER USING SAME**

**REFERENCE TO RELATED APPLICATION**

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This is a continuation in part of U.S. Patent Application Serial No. 10/153,140  
filed 05/20/2002 by K. W. Brown *et al.* <sup>now U.S. pat. No. 6,765,535</sup> and entitled **MONOLITHIC**  
**MILLIMETER WAVE REFLECTOR ARRAY SYSTEM** (Atty. Docket No. PD  
01W176) the teachings of which are hereby incorporated herein by reference and  
10 from which priority is hereby claimed.

**BACKGROUND OF THE INVENTION**

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Field of the Invention:

This invention relates to power devices. Specifically, the present invention  
relates to semiconductor power devices.

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Description of the Related Art:

Techniques have been developed for producing W-band semiconductor power  
devices (e.g. 50 Ghz to 120 Ghz). For example Gunn and Impatt diode sources have  
25 been developed which produce ¼ watt of power. However, these sources are very  
expensive. Indium Phosphide High Electron Mobility Transistor (InP HEMT)  
amplifiers have been developed which produce 1/10 watt of power. However these  
devices range from \$10,000 to \$20,000 in cost. Lastly, technologies are being

developed which produce heat with high-frequency microwave beams. These technologies require power in the 100 KW to 1 MV range. However, devices implemented with these technologies (tubes) may cost millions of dollars each.

5 In general, devices implemented with conventional technologies do not generate affordable power in the W-band. In addition, the flexibility of conventional power systems, such as Gunn and Impatt diodes and InP HEMT amplifiers, is limited.

Thus, there is a need in the art for a cost effective high power W-band power system. That is, there is a need in the art for a W-band power system that can be inexpensively configured, to provide variable output power levels. Lastly, there is a  
10 need for a W-band power system that takes advantage of current semiconductor manufacturing technology to minimize costs.

The above-referenced related U.S. Patent Application Serial No. 10/010,140  
*now U.S. Patent No. 6,765,535*  
filed 05/20/2002 by K.W. Brown *et al.*, and entitled MONOLITHIC MILLIMETER  
WAVE REFLECTOR ARRAY SYSTEM (Atty. Docket No. PD-01W176) addresses  
this need by providing a monolithic millimeter wave reflect array system. However,  
there is a further need for a transmissive mode implementation and for a system or  
method for providing an in-line amplifier using the array.

## SUMMARY OF THE INVENTION

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The need in the art is addressed by the amplifier of the present invention. In the illustrative embodiment, the amplifier includes a monolithic semiconductor substrate and an array disposed on said substrate for coherently receiving and retransmitting electromagnetic energy. In a specific embodiment, the array is implemented with a plurality of cells. Each of the cells includes a dual polarization antenna structure for receiving electromagnetic energy and an amplifier connected thereto.